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WATER QUALITY BASIC DATA PROGRAM. OPERATING MANUAL, FOR COLLABORATING LABORATORIES

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

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WATER QUALITY BASIC DATA PROGRAM

OPERATING MANUAL

A Guide for Laboratories Collaborating in Sampling
and Analytical Activities Under the
Water Quality Basic Data Program

U. S DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Public Health Service
Bureau of State Services
Division of Sanitary Engineering Services
Robert A. Taft Sanitary Engineering Center
Cincinnati 26, Ohio

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SECTION I

THE WATER QUALITY BASIC DATA PROGRAM

The Public Health Service responsibility for a water quality basic data program arises from the recommendations of the Presidential Advisory Committee on Water Resources Policy. This recommendation was enacted into law as Section 4(c) of Public Law 660, 84th Congress.

The program will (a) provide a continuous record of basic water quality data taken at key points on the major waters of the nation; and (b) provide data that can be useful in various water quality improvement operations. The National network of stations should be considered as reference points and should be supplemented with intra-state or intra-basin nets operated by State and local agencies.

The principal objectives of the program are to furnish:

a. Continuous information on the nature and extent of pollution affecting water quality.

b. Long term information on changes in water quality as affected by changes in water use and development.

c. Data which will guide State, interstate, and other agencies in their water pollution control programs.

d. Data on water quality useful in the development of comprehensive water resources programs.

e. Data useful in selection of sites for municipal and industrial water use, and for other legitimate purposes.

Sampling locations have been selected on the basis of one or more of the following general criteria:

a. Major waters used for public water supply, propagation of fish and wildlife, recreational purposes, and agricultural, industrial and other legitimate uses.

b. Interstate, coastal and Great Lakes waters.

c. Waters on which activities of the Federal Government may have an impact.

With its selection as one of the network of key stations, the cooperating laboratory occupies a unique position. Data collected at this and the other network stations will serve as a foundation for the evaluation of water pollution control progress, both on a State and National level. The data will also reflect trends in water quality over the years, thus providing an intelligence service on the quality of the water resources of the nation. Finally, the cooperating laboratory will be in the position of a connecting link, or reference point, in intra-state or river basin pollution abatement programs.

LABORATORY ANALYSES

The analyses to be carried out have been selected on the basis of emerging and foreseeable problems in water quality management, as described below.

Radioactivity

Interest is rapidly growing in routine monitoring of water supplies for radioactivity. With the development of nuclear power reactors and other peacetime atomic energy uses this interest will become even more intense. State and interstate agencies, and municipalities are becoming increasingly concerned about establishing such programs. Experience with this network will, it is hoped, encourage and stimulate more effective State and local programs in radiation monitoring.

Organic Chemicals

Many signs point to the continued rapid expansion of the chemical industries and to their extension to relatively new geographic areas. A doubling of the industry's production capacity by 1975 has been predicted. Expansion of the petro-chemical industry in the interior of the nation has also been predicted. Wise foresight demands that data must be obtained on the presence of wastes from these organic chemical industries in our surface waters. This need is made more urgent by the increased use of insecticides, pesticides, fungicides, and other economic poisons, since most of this material reaches watercourses through land drainage. The increase in use of detergents in the past 10 years is common knowledge.

In most cases trace concentrations of these organics are sufficient for interference with water treatment processes and other legitimate water uses. Existing analytical procedures are either not sensitive enough to

detect these new pollutants, or very few laboratories are staffed and equipped to carry out this type of analysis. The carbon filter technique has been recently developed as a tool for collecting and identifying these materials. It is the best tool available at this time; therefore it is being used in the national network. An added advantage in this analysis is the fact that the material recovered represents a tangible and relatively permanent record of pollution, remaining stable for long periods after collection and isolation.

Biological Populations

Plankton frequently cause taste, odor, clogging of filters, and other difficulties in treatment of water. Plankton are the source of food for certain organisms which are in turn used by fish as a food source. Finally, plankton productivity is directly related, through oxygen production as well as growths, to the degree of organic enrichment of the streams, which has been contributed by human wastes and industrial wastes of sewage-like character. Accordingly, a continuous record of plankton populations provides information of importance to water treatment plant operators, and to conservation and water pollution control agencies.

Plans are also being made to incorporate sampling locations for bottom organisms and fisheries studies. Initial activities will include assembly of information on sport and commercial fishing, as such may be related to water pollution, from reports and publications of Federal agencies, State water pollution control agencies, State conservation agencies, and others on present and proposed programs in both clean and polluted waters.

Coliforms

The presence of these organisms in water is direct evidence of the presence of sewage. The degree of contamination of the water by these organisms will be of interest to the municipality using the stream for its source of water. The delayed membrane filter technique will be used to carry out this test, in order to avoid shipment of samples and delay in making the laboratory analyses.

Significant Chemical and Physical Parameters

There are many standard chemical and physical measurements which can be made on water. Those of significance to the establishment of water quality vary with the purposes for which the water is to be used. The determinations selected below are of basic value to most water uses; therefore they have been included in the Basic Data Program. In certain locations

other determinations, of local significance, may be added as the program develops. The determinations to be made at each network station are:

Alkalinity (or acidity)	Dissolved Oxygen
Ammonia Nitrogen	Hardness
Biochemical Oxygen Demand	Hydrogen Ion Concentration (pH)
Chemical Oxygen Demand	Sulfate
Chloride	Temperature
Chlorine Demand	Total Dissolved Solids
Color	Turbidity

Many of the cooperating laboratories are performing most of these tests routinely, but a few of them may need to expand their routine to include some of these analyses. The Public Health Service will assist individual laboratories in every way possible, in order that these determinations will be available from each network station. All data collected at each sampling point will be freely exchanged between the Public Health Service, cooperating laboratory and the State agency responsible for water pollution control.

Basic Data Reference Samples

In a national program where analytical results originate from a multitude of laboratories under different jurisdictions, it is essential that the laboratory data be comparable as to precision and accuracy. The Basic Data Reference Sample activity is a mechanism by which this objective can be achieved. Reference samples will be submitted to each of the collaborating laboratories periodically to assure continued precision and accuracy of all data submitted. Past experience with several Federal and State laboratories has shown that this mechanism leads to increased proficiency of all participants. In addition, it has served to point up routine errors within a laboratory which would otherwise have gone unnoticed.

Sampling

All samples are to be of raw waters and are to be collected by the participating laboratories and agencies. All samples are to be collected from the flowing stream or from the raw water intake prior to any treatment, including sedimentation, prechlorination, etc. Samples for determination of radioactivity, organic chemicals, plankton populations, and coliforms are to be shipped to the Public Health Service at Cincinnati for analysis. The chemical analyses will be performed by the cooperating laboratories on samples collected at the same time. Procedures for collection, shipment, and analyses of samples are given in subsequent sections of this manual.

All sampling containers, shipping cases, and other materials will be provided and all shipping charges will be paid by the Public Health Service. Carbin filter units, packed with carbon, will be furnished in individual shipping containers. Containers and shipping cases will be provided for the remaining samples.

Cooperating laboratories are encouraged to develop laboratory competence in the analyses to be made at Cincinnati. The Public Health Service will furnish all possible assistance through training, methods, consultation, reference samples, loan of equipment, and other resources which may be available.

SECTION II

GENERAL INSTRUCTIONS

Routine collection of samples for shipment to the Sanitary Engineering Center will be carried out according to detailed instructions for collection and shipment presented in subsequent sections of this manual. The program includes the following:

a. Carbon Filter - monthly: Start filtration on that day of the week on which a sample is collected for the chemical and physical analyses.

b. Plankton Populations - monthly: One 5-1/2 pint sample. Collect on the afternoon of that day on which a sample is collected for the chemical and physical analyses.

c. Chemical Oxygen Demand - weekly and monthly: Although this determination is to be performed weekly by the cooperating laboratory as a part of the conventional chemical and physical analyses, a duplicate sample will be furnished to the SEC once per month. This sample should be measured out from the sample of water collected for the B. O. D. analysis. Space has been provided in the carbon filter container for shipment of this sample. Details will be found in Section VII.

d. Coliforms - weekly: This sample should be collected weekly, on that day in which a sample is collected for the chemical analysis. Membrane filtration and mailing of this sample to SEC should be done as quickly as possible after collection.

e. Radioactivity, Water - weekly: A 1-liter raw water sample should be taken weekly, on the same day a sample is collected for the chemical analysis.

f. Radioactivity, Plankton - monthly: Techniques for collection of plankton samples for radioactivity are now being developed. This phase will be included in the program later.

SAMPLING SCHEDULES

Weekly and monthly sampling schedules should be set by each participating laboratory to best fit in with normal routine operations. Once the schedule is established, however, it should be followed as closely as plant operations permit. A suggested sampling schedule is as follows:

First Monday of each month:

1. Collect chemical analysis sample. Analyze, and mail report forms.
2. Collect, filter and mail the membrane filter coliform sample.
3. Collect raw water radioactivity sample. Mail to SEC.
4. Start the carbon filter run.
5. Collect and ship the plankton sample.

Second Monday of each month:

1. Same as first Monday .
2. Same as first Monday.
3. Same as first Monday.
4. Collect C. O. D. sample and place in the carbon filter shipping case.

Third Monday:

1. Same as first Monday.
2. Same as first Monday.
3. Same as first Monday.
4. Remove carbon filter and ship to SEC. (This may be done any day during the second week, when the carbon filter run may be completed.)

Fourth Monday:

1. Same as first Monday.
2. Same as first Monday.
3. Same as first Monday.

Fifth Monday:

If the month has five Mondays, repeat the fourth week's schedule. If a holiday should fall on a Monday, begin the sampling on the first work-day following the holiday.

SHIPPING INSTRUCTIONS

All samples, except the carbon filter samples, are to be shipped by mail or parcel post to:

Director
Robert A. Taft Sanitary Engineering Center
U. S. Public Health Service
4676 Columbia Parkway
Cincinnati 26, Ohio

Attention: Basic Data Unit

The carbon filter samples are to be shipped by Railway Express, Charges Collect, to the above address. Addressed franked mailing labels and mailing tubes will be provided for each sample shipment.

ASSISTANCE WITH SAMPLING, LABORATORY, AND OTHER OPERATIONAL PROBLEMS

If questions or difficulties arise in connection with the directions and procedures outlined in this manual, the participating agency should contact the Sanitary Engineering Center by telephone (collect) or by other means of communication, as dictated by the urgency involved. The Center may be reached by telephone in Cincinnati, Ohio, at Trinity 1-1820. All requests for assistance are to be directed to the attention of Stephen Megregian, In Charge of Laboratory Services, Water Quality Basic Data.

SECTION III

INSTALLATION OF EQUIPMENT AND COLLECTION OF CARBON FILTER SAMPLES

The carbon filter consists of a piece of pyrex glass pipe 3 inches in diameter and 18 inches in length. The ends are fitted with brass plates and 3/4-inch galvanized nipples. A stainless steel screen is fixed in a neoprene gasket at both ends. The filter unit will arrive packed with activated carbon ready for use. The special shipping container provided should be used when returning the filter. The unit, with the shipping container, is illustrated below.

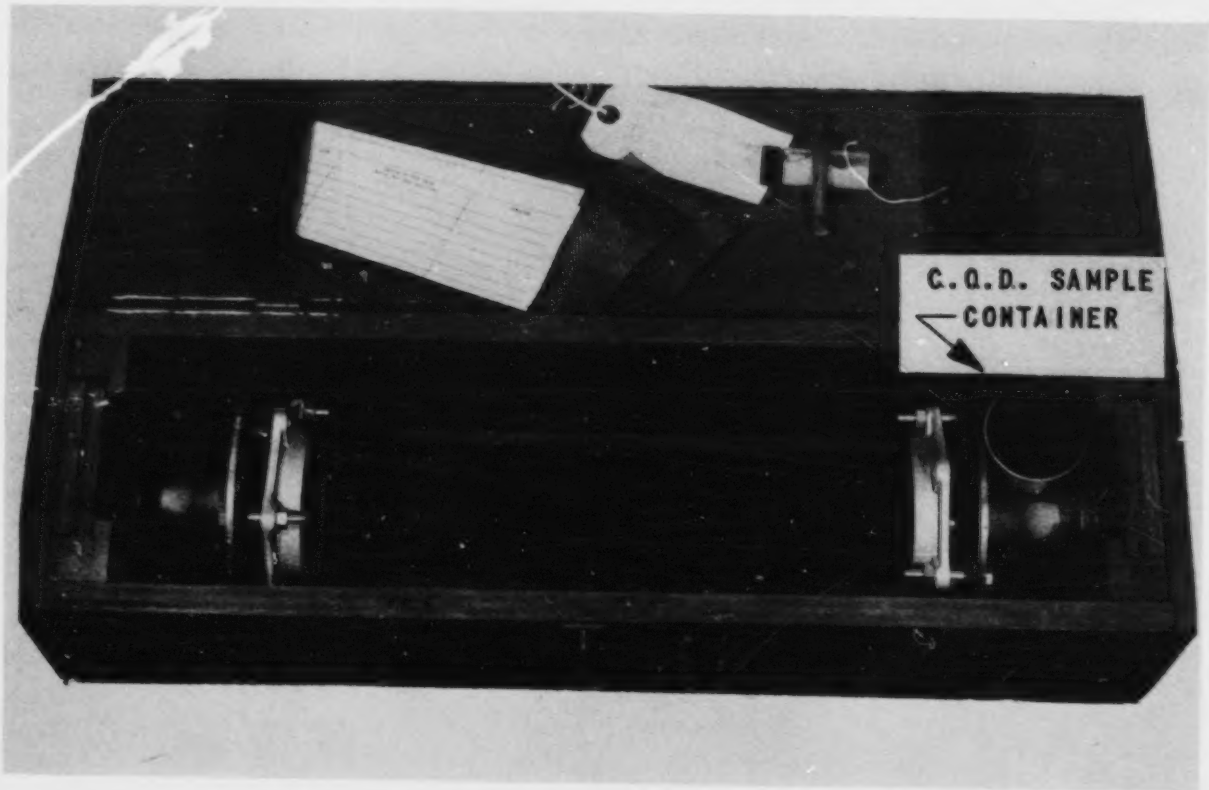

Figure 1 - Carbon Filter Unit and Container, with COD Sample Container.

PRESETTLING, PREFILTER, AND BACKWASH

River waters will frequently clog the carbon filter before the desired amount of water has been sampled. It is necessary to remove sufficient turbidity to permit the required amount of water to pass through the unit. This may require a presettling tank, and a prefilter containing sand and gravel. For waters having less then 100 ppm of turbidity, a presettling tank is generally not required.

PRESETTLING TANK

A standard hot water tank connected with the inlet at the bottom and outlet at the top, with a clean-out tap at the bottom can serve as a presettling tank. The outlet connects to the prefilter containing sand and gravel. The hot water tank should be flushed at frequent intervals to prevent a large accumulation of solids. Open settling tanks can be used if care is taken to prevent long detention times and biological action. With open tanks a pump will be required to move the water through the filter.

SAND PREFILTER

The sand prefilter consists of a standard piece of steel pipe 3 inches in diameter and 3 feet long, threaded at both ends, and equipped with 3" X 1" reducer couplings. Two disks of stainless steel screen (supplied by the SEC) are fitted to the inside diameter of the pipe. A simple way to prepare and hold the screen in place is to cut out a disk about the size of the outside diameter of the reducer, and then push it into place so that it is below the threads. The screen is held tightly against the inside of the reducer. The pipe is packed with 6 inches of 1/8" gravel, 24" of 0.6 to 0.8 mm sand, and another 6 inches of 1/8" - 1/4" gravel. No free space is left in the pipe. The gravel should be packed by jarring the pipe while fitting. This arrangement provides a strainer rather than a filter with a movable bed. By such an arrangement backflushing can be done without disturbing the filter. The construction details are shown in the diagram on page 3-3. The dimensions may be varied according to local conditions.

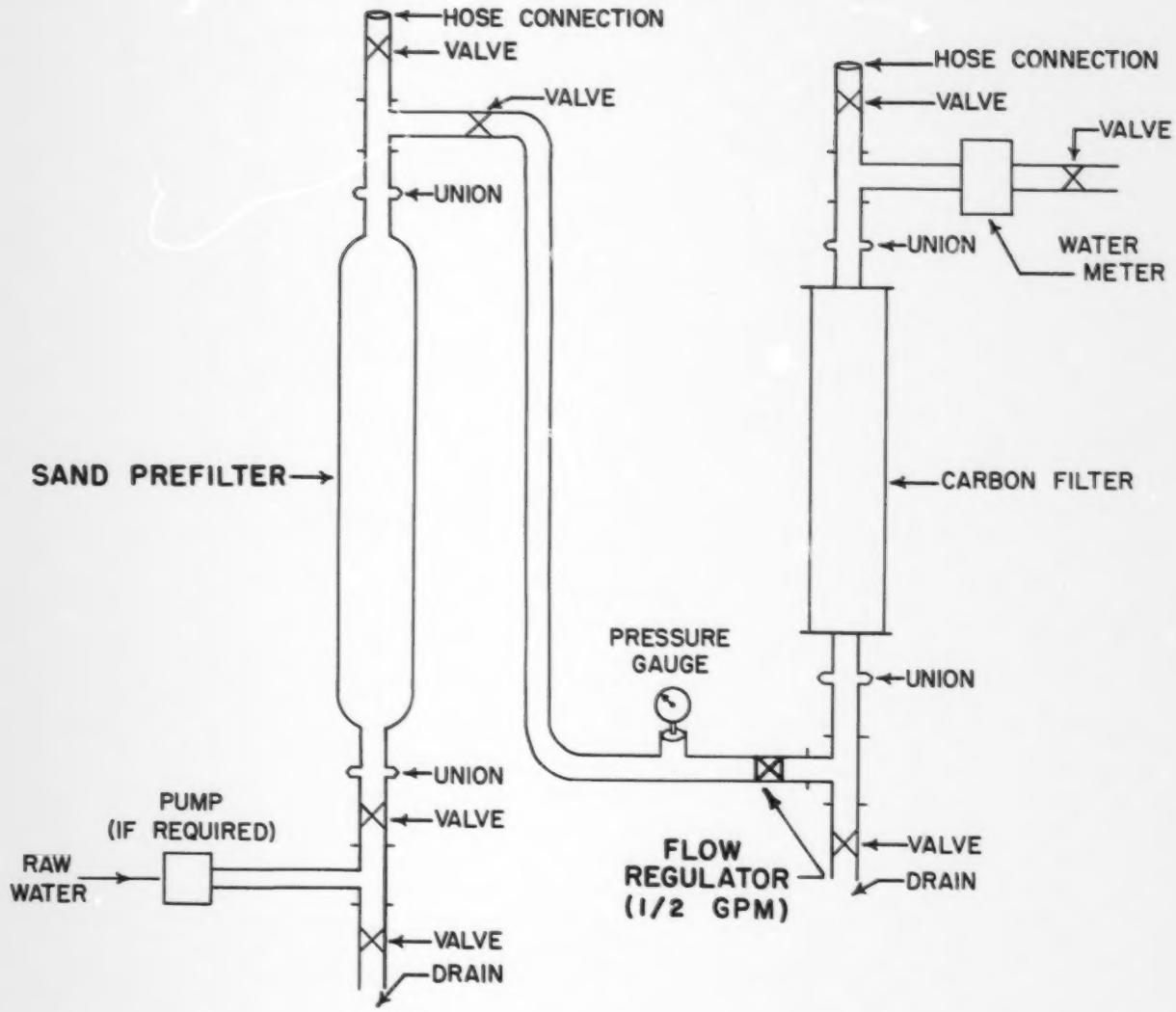

FIGURE 4 – SCHEMATIC DIAGRAM OF PIPING INSTALLATION FOR SAND PREFILTER AND CARBON FILTER

FILTER ARRANGEMENT

The presettling tank, the sand prefilter, and the carbon filter should be installed at the most convenient source of raw water. If less than 15 psi pressure is available, it may be necessary to pump the water through the system. A schematic drawing of a workable system is shown on the following page. Exact lengths of pipes, etc. are not given, since these will vary with the local situation. Both the sand and carbon filters should be connected with unions at both ends for easy removal. A typical installation is shown in the photograph on page 3-6.

The raw water passes into the bottom of the sand prefilter, around and into the bottom of the carbon filter. When the rate of flow through the system falls below 1/4 gpm backwashing of the sand filter is necessary, using a high pressure source of water. A clean hose is connected to the top of the sand filter, the valve to the carbon filter is closed, the drain valve on the sand filter is opened and the sand is back-flushed until the water coming out is clear. The length of time between backwashings will vary. On the Missouri River, for example, it has been found that once every 24 hours is sufficient. After backwashing connect the system as before and continue the sampling. Be sure to disconnect hose at top of sand filter after backwashing. A pressure gauge is inserted in the system to indicate when clogging is taking place in the carbon filter. Total pressure in the filter should not exceed 50 psi.

A water meter, located at the end of the system to prevent excessive fouling of the meter, is used to measure the volume of water sampled. It is good practice to disassemble and clean the meter thoroughly after each run. A 5/8" x 3/4", disk-type meter, registering in gallons and capable of measuring flows as low as 1/4 gallon per minute, is best suited for this purpose. A valve following the meter serves to throttle the flow if necessary. A flow-regulating device may also be used for this purpose. The complete installation is shown in the schematic diagram on page 3-5.

Fine carbon washes out of the filter when it is first started. A few gallons of water can be passed through the top connection and through the carbon filter drain before cutting in the meter, to keep the meter free of the carbon. The hose connection and drain on the carbon filter can be used to back-flush the carbon should it become clogged. This is a last resort and should only be used if absolutely necessary.

The system outlined is not intended to remove all traces of turbidity from the water before passing through the carbon filter. Its purpose is to take out gross materials, most organisms, and permit the required volume

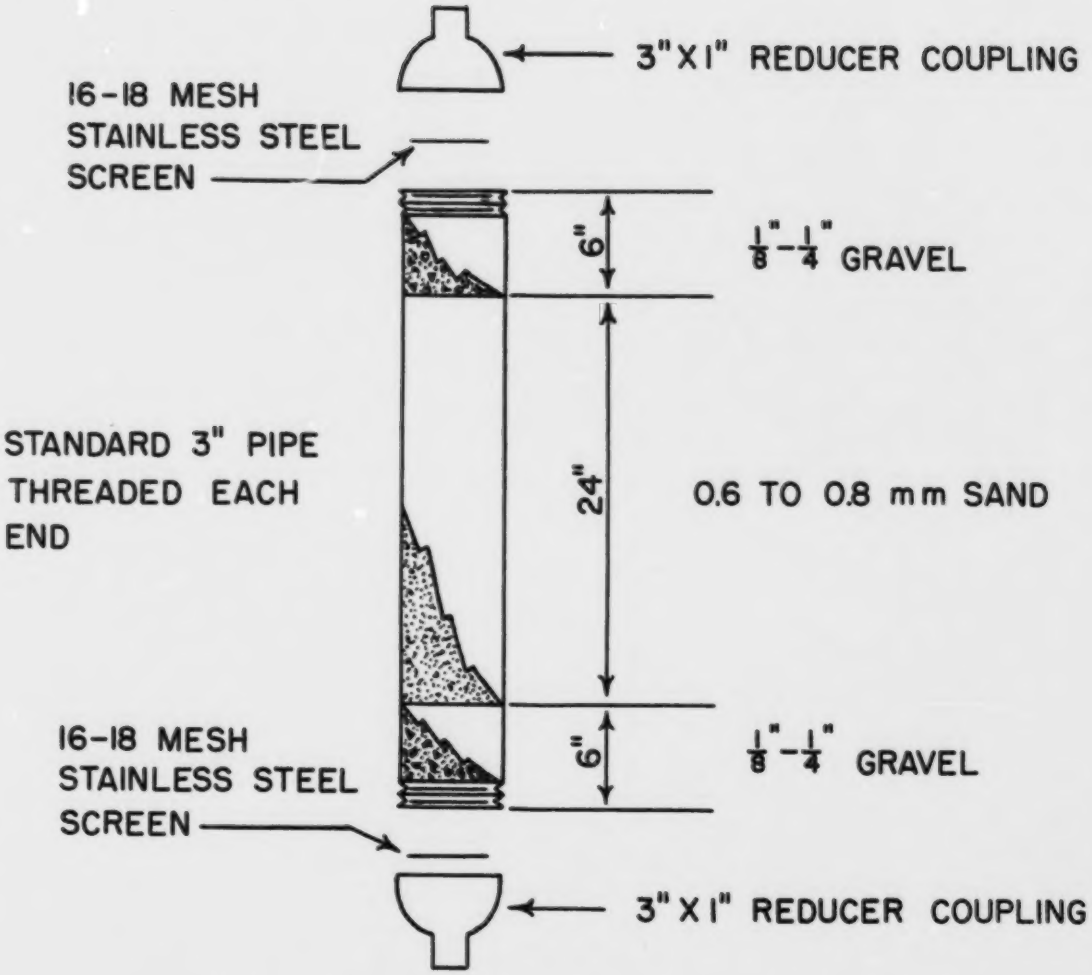

FIGURE 2 – DETAILS OF SAND PREFILTER

of water to pass through the carbon. The valve nearest the bottom of the sand filter is to be closed when it is desired to obtain a sample of raw water directly for other analyses. The drain valve is opened and, after flushing, the necessary raw water sample is collected.

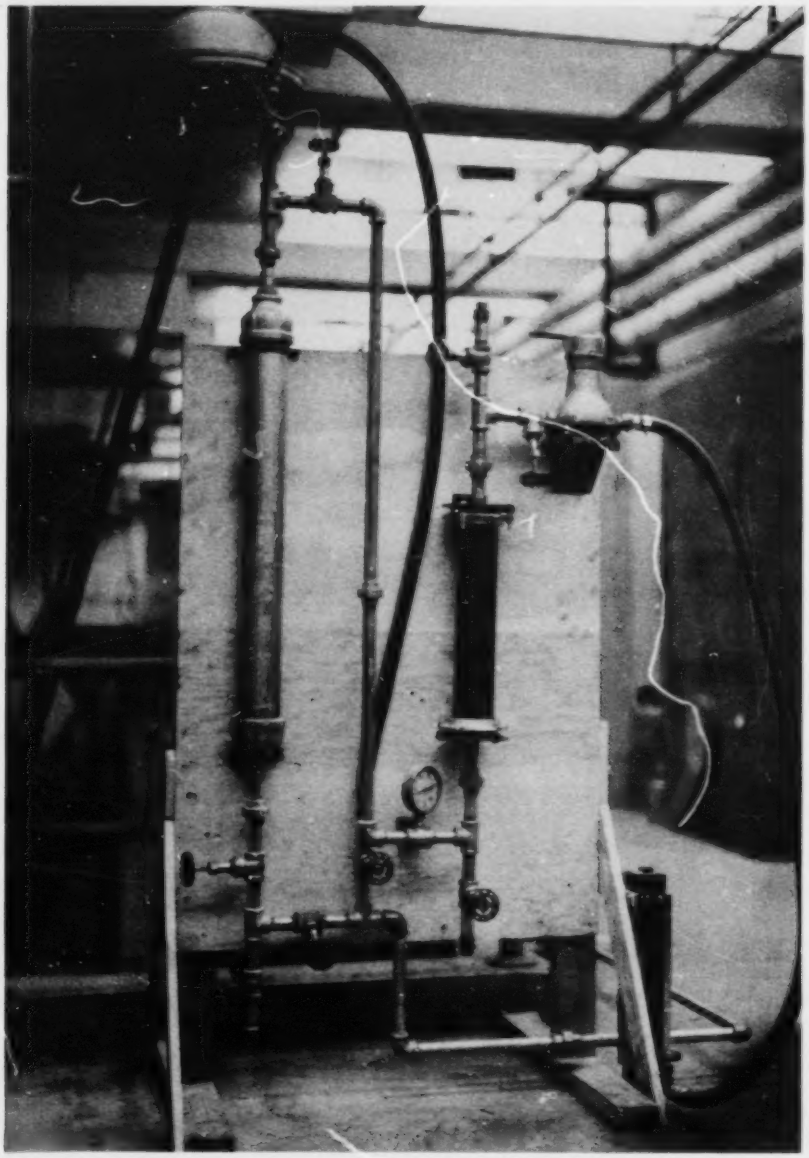

Figure 3 - Typical Carbon Filter Installation.

PUMPING

If adequate pressure is not available for sampling raw water, it is necessary to pump through the filter system. It is important that the pump used does not contaminate the sample through oily packing or other sources. New pumps are sometimes grease coated and should be thoroughly cleaned before being put into service.

If a lift of more than 12 feet is required, it will be necessary to use a jet-type pump. A model suitable for the conditions should be selected.

The pumps listed below have been found to be satisfactory under the conditions stated. However, any pump can be used which will perform properly and is not a source of organic contamination.

Where the lift is not over 12 feet, a small centrifugal pump may be used, such as:

JABSCO model 2187 — Approximate cost - $60.00
115 volt A. C.
1/2" Bronze with Neoprene Impeller
Manufactured by Jabsco Pump Company
2031 N. Lincoln Street
Burbank, California

Montgomery ward — Approximate cost - $50.00
Catalog No. 87 FE 5445 MB
Motor and Rubber Paddle Impeller Pump
(1956 Farm Catalog B)

Where the lift is over 12 feet, the following, or equivalent, are suggested:

Sears, Roebuck & Company — Approximate cost - $150.00
Catalog No. 42 HM 3094 W
Deep Well Jet Pump System
3/4 H. P. Motor, 30-gallon tank
110-120 volt A. C.
(Will lift up to about 100 feet)

Fairbanks-Morse Jet Pump — Approximate cost - $100.00
12-gallon pressure tank — (with deep well kit)
Model H657
(will lift up to 25 feet, conversion kit available for lift up to 60 feet)

When little or no lift is required, but the water must be pumped over a considerable distance to the carbon filter unit, then the following unit, or equivalent, is suggested:

Aurora APCO Turbine Type — Approximate cost - $100.00
Model D4
1-1/4" suction x 1-1/4" discharge, self-priming
1/4 H. P. Motor, Single Phase, 115/230 volt
Manufactured by Aurora Pump Company
Aurora, Illinois

Before a new pump is put into service, it should be thoroughly flushed with hot water containing a little detergent. The pump should be operated against the minimum amount of head required to get the water through the filter. This may require by-passing of part of the flow.

COLLECTION OF SAMPLE

Water should be passed through the filter at a rate of 1/4 to 1/2 gallon per minute until up to 5000 gallons have been filtered. With highly turbid waters clogging may occur earlier. Although a suitable sample can sometimes be obtained with several hundred gallons, it is desirable to filter a minimum of 2000 gallons, if at all possible. A flow regulating device set at 1/2 gpm can be placed in the system ahead of the carbon filter. A suitable unit can be obtained from the Dole Valve Company, 6201 Oakton Street, Morton Grove, Illinois, or from any other source available to the participating laboratory. These devices generally need a minimum pressure of 15 psi for proper operation.

Since the aim of this program is to get a quantitative measure of organics in water, it is very important to have accurate flow measurements. If difficulties of flow occur this should be noted on the log sheet provided with each filter. Meter readings should be recorded daily on log sheets, and should be designated either in GALLONS or CUBIC FEET.

PRECAUTIONS

The purpose of the carbon filter is to adsorb small amounts of impurities from the water. It is important to avoid contamination of the carbon from other sources. Hence the following should be observed:

a. New galvanized fittings are usually coated with oil or grease. The oil should be removed by washing in kerosene followed by a detergent wash before such fittings are used for making connection to the filter.

b. Ordinary organic pipe jointing compounds should not be used. Red lead (lead oxide) mixed to a paste with water can be used for this purpose. A small supply of red lead is furnished with the filter.

c. Plastic hose is to be avoided, and if rubber hose is used in any connections it should be flushed thoroughly before being connected to the filter. Copper tubing is ideal for connections.

SHIPPING

When the sampling period has been completed, disconnect the filter and drain off the excess water. Cap both ends and place filter in the shipping box provided. Enclose the record of the filter operation in the box. Ship the filter via Railway Express - Charges Collect - to the address given in a previous section.

SECTION IV

COLLECTION OF SAMPLES FOR RADIOACTIVITY MEASUREMENTS

Radioactivity measurements will be made on samples of water and aquatic organisms.

WATER

Radioactivity measurements will be made on grab samples. A one-liter portion of raw water will be collected on a weekly basis.

The sample should be collected at the same time that a portion is taken for chemical analysis. It should be taken from the raw water intake line, prior to any treatment whatever within the plant. This sample must reflect river quality, therefore it should be taken before there is any opportunity for sedimentation. Rinse the bottle with the raw water before filling it to the bottle neck. Be sure to fill out the enclosed tag and attach it to the bottle. The sample bottle and shipping container are shown in Figure 5.

Figure 5 - Bottle and shipping container for water samples for radioactivity.

PLANKTON

The procedure for the collection of this sample is being developed and will be forwarded as soon as it becomes available.

SECTION V

COLLECTION OF PLANKTON SAMPLES

Each plankton shipping container will contain an appropriate sample bottle in which is a supply of formalin preservative sufficient for one shipment.

The monthly plankton sample must be taken in the afternoon and on the same day the raw water is sampled for the chemical analysis. The bottle is to be filled but not overflowed with water. DO NOT RINSE. The sample is to be taken from the raw water inlet or from the stream. If possible, the sample should be taken before the water goes through a pump, and always before any treatment whatsoever, including prechlorination, sedimentation or coagulation. If the sample is obtained directly from the stream, it should be taken just above the plant intake.

Labels or tags will be provided with each sample bottle. Be sure the bottle is identified with the information requested.

Figure 6 - Bottle and shipping container for plankton sample.

SECTION VI

MEMBRANE FILTER DELAYED INCUBATION PROCEDURE

Samples for the coliform examinations are to be collected weekly, at the time that collections are made for the chemical analyses. Examinations will be made by the memorane filter delayed incubation technique. Because of the nature of coliform organisms, it is very important that every effort be made to filter the sample, transfer the membranes to the preservative medium, and mail to the SEC without undue delay. Samples of water shipped long distances into a central laboratory often do not represent a true picture of the coliform populations present at the time of sample collection, where an undue delay has occurred.

SUPPLIES

The Public Health Service will provide the necessary filtration equipment to those cooperating laboratories which do not already have it on hahd. All other necessary supplies will also be provided by the Service. The filtration apparatus and shipping containers for the samples are shown in Figure 7.

The SEC will provide, every three months, the following supplies for the membrane-filter-coliform test. When the current supply of most or all of the items is exhausted, please return the shipping container with any unused materials to the SEC. Do not use the supplies from a given shipment for longer then 3 months, if these appear to have deteriorated during storage. (Do not delay in returning the shipping container)

Each shipping container (3-month supply) forwarded to the cooperating laboratory will contain:

Sterile base medium (15 ml)	13 tubes
EHC dry indicator powder (0. 3g)	13 tubes
Denatured alcohol (25 ml)	1 tube
Sodium benzoate solution 12% aq. (25 ml)	1 tube
Sterile ointment tins (3 tins/pack)	13 packs
Sterile MF filters with absorbent pads (10 per pack)	4 packs
Phosphate buffer concentrate (20 ml)	1 tube
Mailing cartons	13 each
Addressed franked labels for cartons	13 each
Transmittal forms	26 each

SECTION VI a

MEMBRANE FILTER DELAYED INCUBATION PROCEDURE

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SUPPLIES

The Public Health Service will provide the necessary filtration equipment to those cooperating laboratories which do not already have it on hand. All other necessary supplies will also be provided by the Service. The filtration apparatus and shipping containers for the samples are shown in Figure 7.

The SEC will provide, at frequent intervals, the following supplies for the membrane-filter-coliform test. When the current supply of most or all of the items is exhausted, please return the shipping container with any unused materials to the SEC.

Each shipping container forwarded to the cooperating laboratory will contain:

M-Endo Broth MF	1/4 pound
Denatured alcohol (25 ml)	1 tube
Sodium benzoate solution 12% aq. (25 ml)	1 tube
Sterile ointment tins (3 tins/pack)	13 packs
Sterile MF filters with absorbent pads (10 per pack)	4 packs
Phosphate buffer concentrate (20 ml)	1 tube
Mailing cartons	13 each
Addressed franked labels for cartons	13 each
Transmittal forms	26 each

SAMPLING

The procedure for preparation of samples is given below.

Equipment and Materials

a. Filter flask of 1000 ml or 2000 ml capacity.
b. Vacuum source (pump or aspirator).
c. Sterile graduates or pipettes for measuring sample.
d. Sterile, phosphate buffered distilled water, 99 ml in each. (In an emergency, sterile dechlorinated tap water may be used as a substitute, although this is not a desirable practice.)
e. Three sterile membranes with ointment tins and three absorbent pads for each sample to be examined.
f. Forceps immersed in pure ethyl (or methyl) alcohol.
g. Medium (see below)

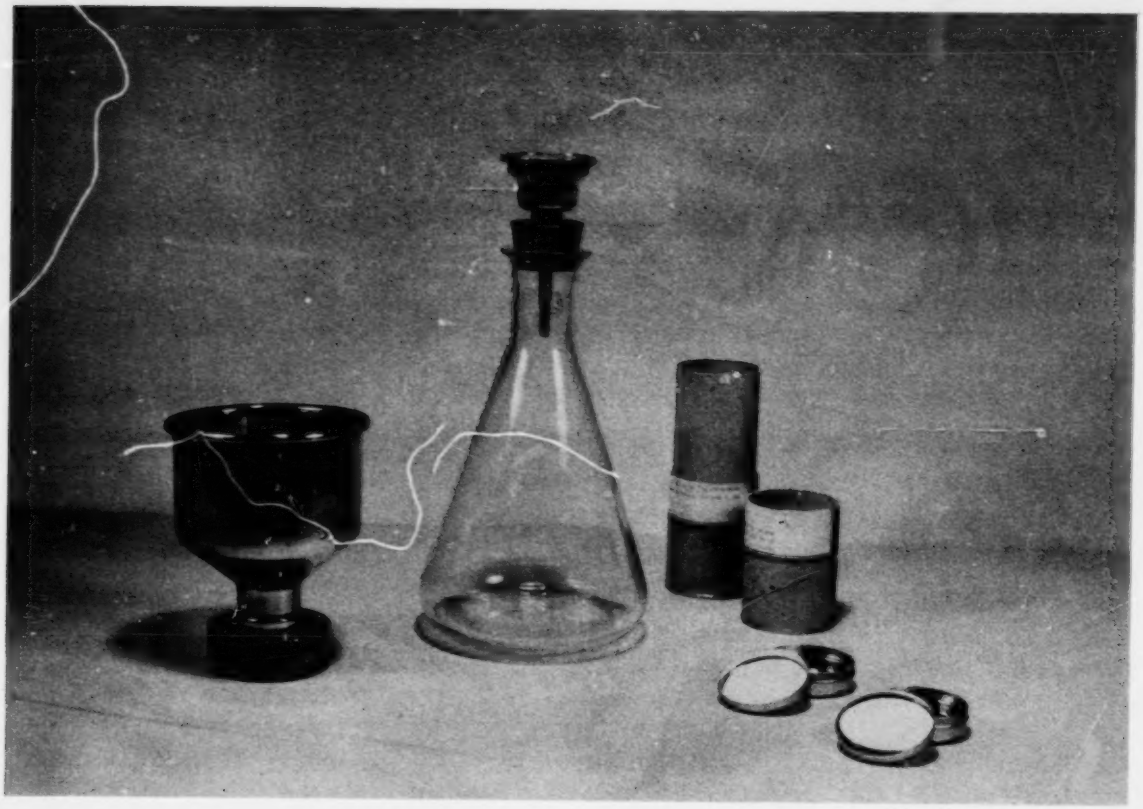

Figure 7 - Filtration apparatus and shipping containers for coliform samples.

Preparation of Equipment

a. Wrap funnel and receptacle in kraft paper in separate packages and sterilize in autoclave for fifteen minutes at 121° C (15 psi). For emergency use in absence of sterilization facilities, immerse funnel and receptacle in boiling water for five minutes, assemble in the filter flask and draw enough air through porous support disk of receptacle to remove excess water. Allow to cool before filtering samples.

b. Membranes and absorbent pads are supplied from the Sanitary Engineering Center, Cincinnati, Ohio. Both the membranes and pads are supplied in sterile packets in kraft envelopes or kraft packages and are ready for use in the procedure.

c. Sterile ointment tins in units of three tins are packed in the mailing cartons. The ointment tins are ready for use. Place the absorbent pad in the top of ointment tin - never the bottom.

d. Pipettes, sample bottles, graduates and other equipment should be properly protected by kraft paper and sterilized at 170° C in dry heat for one hour or by steam under pressure (autoclave for 30 minutes at 121° C, 15 psi).

Medium

The medium required for the coliform examination by the delayed incubation membrane filter procedure consists of benzoated Endo (preservative) medium. This medium is stored as four separate components and may be kept at room temperature in an area protected from light for periods up to 4-6 months. Do not store components in the refrigerator. After the components are mixed, using sterile procedures, the finished medium can be used any time within twenty hours, provided it has been stored in a dark place.

a. Materials needed for mixing the benzoated Endo medium are:

(1) Sterile basal medium in 15 ml quantity (supplied in screw cap test tubes from SEC).

(2) Powdered SEC Endo indicator in 0.3 gram quantity (supplied in weighed amount in sterile screw cap test tube from SEC).

Preparation of Equipment

a. Wrap funnel and receptacle in kraft paper in separate packages and sterilize in autoclave for fifteen minutes at 121°C (15 psi). For emergency use in absence of sterilization facilities, immerse funnel and receptacle in boiling water for five minutes, assemble in the filter flask and draw enough air through porous support disk of receptacle to remove excess water. Allow to cool before filtering samples.

b. Membranes and absorbent pads are supplied from the Sanitary Engineering Center, Cincinnati, Ohio. Both the membranes and pads are supplied in sterile packets in kraft envelopes or kraft packages and are ready for use in the procedure.

c. Sterile ointment tins in units of three tins are packed in the mailing cartons. The ointment tins are ready for use. Place the absorbent pad in the top of ointment tin - never the bottom.

d. Pipettes, sample bottles, graduates and other equipment should be properly protected by kraft paper and sterilized at 170°C in dry heat for one hour or by steam under pressure (autoclave for 30 minutes at 121°C, 15 psi).

Medium

The medium required for the coliform examination by the delayed incubation membrane filter procedure consists of benzoated M-Endo (preservative) medium.

a. Materials needed for mixing the medium are:

(1) M-Endo Broth - MF - Dehydrated.

(2) Aqueous sodium benzoate solution, 12 percent (supplied as sterile stock solution in quantity to last three months from SEC). Do not use after the expiration date marked on the label.

(3) Ethyl alcohol (ethanol or grain alcohol, U. S. P. grade, 95 percent).

(4) Two sterile 1 ml pipettes, graduated in 0.01 ml.

(3) Aqueous sodium benzoate solution, 12 per cent (supplied as sterile stock solution in quantity to last three months from SEC). Do not use after the expiration date marked on the label.

(4) Ethyl alcohol (ethanol or grain alcohol, U. S. P. grade, 95 per cent).

(5) Two sterile 1 ml pipettes, graduated in 0. 01 ml.

b. Procedure for mixing benzoated Endo (preservative) medium:

(1) Remove caps from tubes containing the basal medium and the SEC Endo indicator, being careful not to contaminate caps or mouth of tubes.

(2) Pour liquid contents of basal broth tube in tube containing dry indicator powder. Gently agitate the indicator tube to prevent caking of dry powder. Never reverse the order of mixing.

(3) Replace cap on tube containing basal broth-indicator mixture and invert six times to mix powder and liquid. Shaking will create excessive foaming in the medium.

(4) Add 0. 50 ml of sodium benzoate solution (12 per cent) to above mixture, using a sterile pipette and measuring to the nearest 0. 01 ml.

(5) Add 0. 35 ml of ethyl alcohol, using a sterile pipette and measuring to the nearest 0. 01 ml.

(6) Mix by gently inverting tube six times.

(7) Warm medium in hot water until tube is unpleasantly warm on touching to forearm (not over 60°C).

(8) Mix by inverting periodically until the powder is all in solution.

The benzoated Endo medium is ready for use or may be used any time within twenty hours, if stored in a dark place at room temperature.

(5) 100 or 250 ml flask.

b. Directions for preparation of M-Endo Preservative Medium:

(1) Place 50 ml distilled water in a chemically clean 100 to 250 ml Pyrex flask;

(2) Add 1 ml ethyl alcohol (95%);

(3) Add with gentle agitation 2.4 grams dehydrated M-Endo Broth MF;

(4) Heat gently to boiling point to dissolve dehydrated powder (do not boil);

(5) Cool to room temperature;

(6) Add 1.6 ml of sodium benzoate solution and mix gently.

This is the finished medium. It will keep 72 hours in a cool, dark place protected from evaporation.

Remarks:

(1) The dehydrated medium will absorb moisture rapidly which results in caking and spoiling the powder. The jar containing the dehydrated stock medium must be sealed tightly after using each time to prevent absorption of atmospheric moisture.

(2) The dehydrated medium will be supplied in quarter pound jars to those stations which have available a balance with a sensitivity of $\pm$ 0.1 gram.

(3) If no balance is available, the medium will be supplied in small bottles containing 2.4 grams each.

(4) For stations which desire to run the immediate MF test, the quantities can be doubled, medium divided in two 50 ml portions in step "5" and 1.6 ml of sodium benzoate solution added to one portion. The portion without added sodium benzoate can be used as a single step procedure for the immediate MF test, (Fifield, C. W. and C. P. Schaufus, J. A. W. W. A. 1950: 50:193-196).

Quantity of Sample for Examination

Successful examination of untreated water for coliform density is dependent upon securing at least one membrane with, preferably, between 20 and 60 coliform colonies and with not more than two or three hundred colonies of all types. Development of colonies from noncoliform flora is generally restricted to a great extent by the indicator in the medium but there are exceptions. A number of noncoliform colonies will always be present on the membranes except in rare samples where the coliform density numerically exceeds the non-coliform bacteria by many times.

In the delayed incubation membrane filter procedure, the local laboratory does not see the finished membranes to determine conformity with the above requirements. Therefore the central laboratory completing the test will immediately report to the local laboratory when any test is unsatisfactory due to excessive colony density or insufficient number of colonies and, when possible, offer suggested changes in quantities of water filtered for the test.

Unless the coliform density can be estimated with accuracy from existing data, one membrane should be used for each quantity of water filtered and it is usual practice to filter three different quantities for each sample.

When there are no existing data on the coliform density of a water sample, the quantities to be used for routine sampling must be determined by a "trial and error" method. Where reliable coliform data are available from past investigations, the following procedure is recommended for the determination of quantities of water for filtration:

a. Estimate the quantity of water which should contain 20 coliform bacteria (from MPN or other data) and designate this as the "basic test quantity."

b. Filter samples in the order listed below:

   (1) One-third the "basic test quantity" (one membrane).
   (2) The "basic test quantity" (one membrane); and,
   (3) Three times the "basic test quantity" (one membrane).

Example: A river on the last examination by a confirmed test had an MPN of 10,000. Coliform density is 10,000/100 or 100 coliforms

per ml. "Basic test quantity" BTQ in ml is calculated by 20/coliform-density-per-ml giving 20/100 or 0.20 ml. The following quantities would be used as described in Filtration Procedure.

a. One-third the BTQ or $\frac{0.20}{3}$ or 0.07 ml. (Use 7 ml of a 1-100 dilution for this filtration).

b. The BTQ or 0.20 ml. (Use 20 ml of a 1-100 dilution or 2 ml of a 1-10 dilution).

c. Three times the BTQ or 3 x 0.20 0.60 ml. (This may be measured directly after addition of about 20 ml of sterile water to the funnel).

In this example, coliform densities from 3,300 to 85,000 will be determined with one satisfactory membrane containing between 20 and 60 coliform colonies. Although not recommended for routine procedure, under unusual circumstances the coverage could be extended from 1,660 to 142,000 by using counts as low as 10 coliform colonies on the largest quantity or 100 coliform colonies on the least quantity examined.

Filtration Procedure

The membrane filter procedure for coliforms by the immediate incubation test is described on pages 395-404 of Standard Methods for the Examination of Water, Sewage, and Industrial Wastes (10th edition, 1955). The delayed incubation membrane filter procedure has many procedures in common with the immediate test method, and special reference is made to the illustration, "Fig. 20, Membrane Filter Assembly" and discussion in paragraph 6, page 397, for a typical assembly of the filtration units. Variations in the described procedures can be made, depending on local facilities, as, for example, use of an electric vacuum pump or water aspirator, etc. The filtration of the sample after assembly of the equipment is done as follows:

a. Place absorbent pads in sterile ointment tin tops.

b. Saturate each pad with benzoated Endo (preservative) broth.

c. After three or more minutes, remove any excess medium from pads with a sterile pipette.

d. Shake water sample before filtration.

e. Flame forceps and place sterile membrane, (grid side up) in filter receptacle and seal funnel on membrane with care in order to avoid injury to the membrane.

f. Measure water sample in funnel with no vacuum on filter flask.

(1) If volume of sample is 10 ml or more, pour measured sample directly on dry membrane.

(2) If between 0.5 ml and 10 ml pour about 20 ml of sterile water in funnel and measure sample into the sterile water in funnel (for good distribution).

(3) If volume of original water sample is less than 0.5 ml, prepare appropriate dilution and proceed as in item (2).

(4) If water sample is:

Over 20 ml, use appropriate sterile graduate.
Between 2-20 ml, use 10 ml or 20 ml sterile pipette.
Between 0.5 - 2 ml, use 1 or 2 ml graduated sterile pipette.
Less than 0.5 ml, make appropriate dilutions in sterile buffered distilled water.

g. Turn on vacuum and filter sample.

h. Rinse sides of funnel down twice with at least 20 ml of sterile buffered distilled water each time, keeping vacuum on.

i. Remove funnel from receptacle and place on sterile paper.

j. Flame the forceps. Using the forceps, remove the membrane from the filter receptacle and lay it on the soaked absorbent pad in the ointment tin cover, grid side up, with a rolling action starting at one edge, as shown in Figure 8. Use care to avoid trapping air bubbles.

k. Place bottom of tin gently over top and proceed with filtration of next quantity of water. All three quantities in ascending order can be filtered in same funnel apparatus with only the rinsing (described in h) between samples.

l. Let membrane stand for about 5 minutes.

m. Inspect each membrane for colorless spots on the MF, which indicate the presence of air bubbles.

n. If the membrane does not have a uniform pink color, remove and roll on to absorbent pad again.

o. Seal ointment tin by pressing top firmly on.

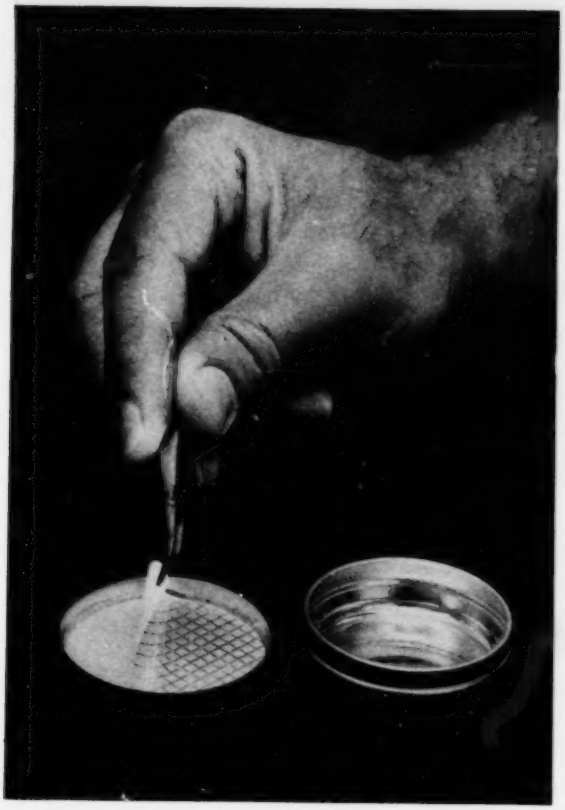

Figure 8 - Placing membrane on pad soaked with preservative medium.

SHIPPING

a. Check the identification marking on top of each box with that recorded on the transmittal sheet. Each ointment tin label should have (1) the date, (2) the station number, (3) serial number of filtration, and (4) quantity of water filtered.

b. Place three ointment tins and transmittal sheet in mailing carton for immediate mailing

c. Samples should be mailed not later than Tuesday night of each week in order to reach Cincinnati before Thursday noon. Airmail stickers will be provided to the laboratories where necessary.

SECTION VII

CHEMICAL AND PHYSICAL ANALYSES

GENERAL

Samples taken for chemical and physical analyses should be representative of the raw water in the river at the intake to the water plant. A large enough sample should be collected to satisfy the requirements for the chemical analyses to be performed. A special sampling technique will be required for the dissolved oxygen and B.O.D. determinations and will be described under these tests. The collected sample should be kept in a closed container except when portions are withdrawn for the various analyses. A 2-liter bottle of pyrex or polyethylene will be satisfactory for a container.

Those analyses affected by standing of the sample should be performed as soon as possible after the sample is collected. This group includes pH, ammonia nitrogen, alkalinity, turbidity, color, and dissolved oxygen.

Detailed procedures are presented below for the chemical and physical analyses of the raw water sample. In most instances the methods described follow closely the procedures in Standard Methods for the Examination of Water, Sewage, and Industrial Wastes (10th edition, 1955). For the sake of uniformity, it is hoped that these procedures will be used by all of the cooperating laboratories in the Water Quality Basic Data Network. However, the laboratories have a free choice in using any procedure which has been found to be satisfactory, provided that its precision and accuracy are within normally accepted limits. The Basic Data Reference Samples, as sent out periodically from the SEC, will be one of the tools by which the precision and accuracy of the various analytical methods in use will be measured.

PROCEDURES

Alkalinity (Standard Methods, p. 35)

The reagents (p. 36) and procedures for total alkalinity (p. 37) are satisfactory. It is recommended that this titration be carried out to a pH of 4.6 using a pH meter to determine the end point. Report results as Total Alkalinity (as $CaCO_3$) in mg/l.

Chloride (Standard Methods, p. 58)

Methods A. B. or C. are acceptable for this determination. Chloride should be reported as mg/l.

Chlorine Demand (Standard Methods, pp. 62-81)

By: Starch Iodide - Thiosulfate Titration

Reagents: p. 63 - 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.1, 3.2, 3.3, 3.4

Procedure: To individual 500-ml portions of raw water in clean 1-liter Erlenmeyer flasks, add progressively, increased quantities of the Standard Chlorine solution in increasing increments of 1 mg/l. Let stand 1 hr. Titrate as in 3.2 and 3.3, those samples with the lesser added chlorine until a residual chlorine greater than 1 mg/l is obtained. Calculate the chlorine demand (1 hr.) on this sample. (P. 83, Section 5.)

Set aside the flasks containing the larger chlorine doses for 24 hours. These are to be protected from fumes, dust, and light, and held at room temperature.

Repeat the titration on the remaining flasks (as above).

Report 24-hour demand on that sample which contained a residual greater than 1 mg/l. (P. 83, Section 5).

In order to avoid unnecessary preparation of reagents, the 0.025 N thiosulfate used for the D.O. determination may be used for this determination by applying a correction factor of 2.5 to the titrations. This will give a limiting precision of 0.1 mg/l Cl_2.

Color (Standard Methods, p. 87)

Use of commercial standards is permissible if they have been calibrated against the platinum-cobalt standards. The CIE system will not be used in this program. Standards will be calibrated by SEC if the cooperating laboratory so desires.

Turbidity and the inability to match the hues of the color standards are the only interferences in this test. Turbidity should be removed only by centrifuge. If the color cannot be matched to the standards, a reasonable approximation of the color value should be reported by the analyst, with the notation that a true match was unobtainable.

Hardness (Standard Methods, p. 108)

The preferred method is by EDTA (Versene) titration using either Method C.1, p. 115 or C.2, p. 116.

Note the precautions in the use of the Ammonia Buffer where Ammonia by Nessler reagent is being determined in the same laboratory.

The soap procedure is acceptable, but should be discouraged, since the EDTA titration is simpler and more precise.

Ammonia Nitrogen (Standard Methods, p. 142)

The distillation procedure is the preferred method. Direct nesslerization will be acceptable, however, if distillation equipment is not available.

Platinum-Cobalt permanent color standards are acceptable. Commercial Standard color disks or solutions are acceptable if they have been calibrated. The Public Health Service will calibrate these if the cooperating laboratory desires.

Hydrogen-Ion Concentration (pH) (Standard Methods, p. 161)

The glass electrode (electrometric) is the most reliable procedure. Every effort should be made to obtain a pH meter. Colorimetric procedures will be accepted if pH meters are not available.

Total Dissolved Solids (Standard Methods, p. 177)

Filter the sample if the turbidity is greater than one. Determine TDS by the procedure described on p. 178 under "Total Residual".

Sulfates (Standard Methods, p. 196)

Either the turbidimetric method B (p, 197) or the gravimetric method A (p. 196) is acceptable. The titrimetric procedure C (p. 198) is not acceptable.

Temperature (Standard Methods, p. 206)

The thermometer used for this measurement should be checked against a Bureau of Standards thermometer. This calibration can be done by the SEC if desired. Temperature of the Raw Water Sample should be taken at the sampling point immediately following its collection. Report as degrees centigrade, to tenths of a degree.

Turbidity (Standard Methods, p. 207)

Turbidity values less than 1.0 on the raw water samples are not significant and may be considered zero.

Dissolved Oxygen (D.O.) and Biochemical Oxygen Demand (B.O.D.) (Standard Methods, pp. 250-266)

Dissolved oxygen and biochemical oxygen are two of the most important measurements of pollution. Because of their importance, great care must be taken to insure that the sampling and analysis are carried out carefully and accurately.

The dissolved oxygen determination measures the concentration of oxygen present in the stream at the time of sample collection. The biochemical oxygen demand is a measure of the amount of oxygen utilized by the biochemical processes which are taking place during the storage of the sample for a unit of time. The usual determination of B.O.D. is based on a five-day incubation period at a temperature of 20° C. The determination consists essentially of two dissolved oxygen determinations, one at the time of collection, and one after the 5-day incubation period. It is expected that most of the samples which will be analyzed in this program will not require dilution.

D.O. Samples:

Samples should be taken from the stream ahead of the water works intake. A sampling device should be used which provides for at least 3 volumes of water to pass through the D.O. sampling bottle without aeration by the atmosphere. The device may contain two bottles, in which case the second bottle may be incubated for the 5-day B.O.D. Collect at least 1 liter of water in a separate bottle, at the same time that the D.O. samples are being taken. It should be set aside and used for the B.O.D. test, if the conditions listed below under B.O.D. sampling are violated. This last sample can also be used for the other physical and chemical determinations and for the C.O.D. analysis. Temperature of the river water should be taken at the time of sample collection and recorded immediately.

The method to be used for the D. O. Analysis is the Alsterberg (Azide) Modification of the Winkler procedure. (p. 255)

The Rideal Stewart Method (p. 256) should be used only if it is known that the sample contains greater than 1. 0 ppm of Ferrous iron.

B. O. D. Samples:

a. When a duplicate D. O. sample is taken, the duplicate bottle may be incubated for the B. O. D. provided that:

(1) the dissolved oxygen in the sample is below the saturation level of 9. 2 mg/l at 20° C.

(2) the dissolved oxygen content is less than 9. 2 and greater than 6. 9 mg/l.

(3) it is known from experience that at least 1. 0 mg/l of the dissolved oxygen will remain after the 5-day incubation period.

b. If any of the three conditions listed above are violated, the duplicate D. O. sample cannot be used for B. O. D. incubation. In this case, the large sample of water taken simultaneously with the D. O. samples is to be used for the B. O. D.

If condition (1) or (2) is violated, let the large B. O. D. sample stand until it has reached a temperature of 20° C or higher. Aerate it vigorously, then let it stand until all of the gas bubbles have disappeared. Transfer by means of a siphon into two D. O. bottles, taking care to fill each bottle completely, without entrapment of air. Determine the D. O. on one of these bottles. Set the other in the incubator for the 5-day period.

If condition (3) is violated, the sample will require dilution before incubation.

Details for the proper preparation and dilution of B. O. D. samples are given from p. 260 on of Standard Methods. Careful attention should be given to the preparation of the dilution water. Extra precautions should be taken to eliminate Copper, Ammonia, and Chlorine. (See p. 261, para. 2. 1)

The proper dilution to set up cannot be readily predicted. It is best, if dilution is necessary, to set up several and to report that dilution which produces an oxygen depletion of about 50% of the initial D. O.

The method of analysis to be used is the Alsterberg (Azide) modification of the Winkler Procedure. (p. 255)

Chemical Oxygen Demand (C. O. D.) (Standard Methods, p. 332)

The sample to be used for this determination should be collected at the same time and from the same location that the D. O. sample is taken. Every precaution should be taken to insure that the sample bottles and other equipment used for the collection of this and the other Oxygen Demand samples be free from organic matter.

The general procedure for this determination begins on p. 332 of Standard Methods. In order that the results of this test may be comparable throughout the network, certain modifications are suggested below.

Para. 3.4 and 3.5 (p. 333): The strength of the standard reagents for this determination will be 0.025N. This strength should be sufficient for most river water samples. The stronger reagents should not be used unless experience has shown that the weaker reagent is inadequate. Standard dichromate and ferrous ammonium sulfate may be prepared as directed and the 0.25 N reagents diluted to 0.025 N. An additional 20 ml of H_2SO_4 must be added to the ferrous sulfate reagent upon dilution.

In the "Standardization Procedure" using 0.025 N $K_2Cr_2O_7$, add 50 ml concentrated H_2SO_4 instead of 20, as stated in Standard Methods and use 8-10 drops of ferroin indicator. Caution: Use the same number of counted drops of ferroin indicator for the blank and samples as used in standardizing. This is necessary, since the indicator contains ferrous iron, which reacts with the $K_2Cr_2O_7$, but by using the same amount of indicator, no correction need be made.

Under 4., Procedure. p. 334: 4.1 Where stream samples contain volatile organic material or chlorides above 50 ppm, the concentrated H_2SO_4 is slowly added to the 0.025 $K_2Cr_2O_7$ solution and dilution water if used, meanwhile rotating the flask to insure thorough mixing. The flask may be cooled either with running water or clamped in a rack and partially submerged until approximately at room temperature. The cool sample is then slowly added to the cooled reagents in the flask, with gentle rotation to mix uniformly and the flask is connected to the reflux condenser at once.

During warm weather, the loss of volatile organic material and unoxidized HCl is much greater if the acid is added directly to the sample without cooling the reagent mixture first.

Should a lubricant be necessary for the reflux joints, only Dow-Corning "Silicone" should be used and excess wiped from ground faces of the condenser tips.

For the sake of uniformity of data, the Silver Catalyst (p. 334, 4.4) should not be used.

C. O. D. Samples for the SEC Laboratory

Space has been provided in the carbon filter shipping container to simplify forwarding of this sample, as shown in Figure 1.

It will be necessary, therefore, to schedule the collection of this sample for the second week of the month. This is necessary in order to avoid errors due to prolonged storage of C. O. D. samples.

Take a 50.0 ml portion (volumetric pipette) from the sample collected for the weekly B. O. D. analysis and transfer it to the C. O. D. bottle. Add (slowly) 10.0 ml of reagent-grade concentrated H_2SO_4 while mixing carefully to avoid localized overheating of sample. Cool the sample bottle. Identify it by filling out the attached tag and place it in the carbon filter shipping box. DO NOT SEND THIS SAMPLE BY MAIL.

SECTION VIII

HANDLING OF ANALYTICAL DATA

REPORTING OF RESULTS

Each cooperating agency is being furnished a supply of Form PHS-2845-1, WATER QUALITY BASIC DATA REPORT (FIELD), for reporting the results of the determinations performed in its laboratory. These are provided as multiple copy "snapout" forms, with interleaved carbons to simplify reporting of results. The distribution of the data is shown on each copy. Essentially, the original or "white" copy is sent to the Water Supply and Water Pollution Program, Public Health Service at Washington, D. C.; the "blue" to the Sanitary Engineering Center at Cincinnati; the "salmon" to the PHS Regional Office serving that area; the "yellow" to the respective State Agency; and the "pink" is to be retained by the cooperating laboratory. Where other agencies are to be supplied with the results, the Sanitary Engineering Center will be responsible for preparing and distributing additional copies of the data. Franked envelopes are provided for mailing purposes.

The Sanitary Engineering Center will make a similar distribution of the results of the determinations performed in the Cincinnati laboratories, using Form PHS-2845-2, WATER QUALITY BASIC DATA REPORT (SEC).

Because the data are to be entered promptly on machine-sorted punch cards, the forms have been designed for easy transcription to the permanent records. A fixed code has been established, which cannot accommodate variations in reporting practice. Therefore, in order to avoid errors in the compilation of the data on a current basis, each reporting laboratory is requested to observe the following procedures in tabulating the analyses on the forms provided:

State: Insert the State in which the sampling point is located.

Station Location: Insert the name of the river being sampled, the city or other geographical "landmark" identifying the location, and the river mileage from the mouth to the station. River mileages will be provided by the Public Health Service.

Laboratory: Insert the name of the laboratory and the person completing the report.

Analytical Results:

Item 1. Temperature: The temperature reading of the sample must be taken immediately at the time of collection. Report as degrees Centigrade to the nearest tenth of a degree. (If a Centigrade thermometer is not available, one will be furnished by the PHS upon request.)

2-8. Results are to be reported to the nearest decimal place shown.

9-13. Self explanatory.

The following items have been reserved for reporting additional determinations on the basis of special arrangements. Where these arrangements have already been made, data should be reported as follows:

Item 14. Report only Sulfates, as mg/l units, in this space.

15. Report only Total Dissolved Solids, as mg/l units, in this space.

16. This space is to be left blank for the present.

In reporting data, round out the values to the nearest unit shown. For example, a Chlorides value of 20.6 mg/l should be reported as 0021 mg/l. The form may be completed with a hard pencil or ball-point pen, or by typing. Whatever the method used, care should be taken to make each copy legible.

A sample completed report form is shown on the following page.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
DIVISION OF SANITARY ENGINEERING SERVICES

FOR WASHINGTON USE ONLY					
1-2	3-4	5-6	7-8	9-10	11-12
CHECKED BY:				DATE	

STATE	STATION LOCATION (River mileage)
Nebraska	Missouri River at Omaha, Nebraska (Mile 642)

LABORATORY	DATE SAMPLE TAKEN
Metropolitan Utilities District. Water Laboratory - J. Erdei	1/6/58

TEST RESULTS

INSTRUCTIONS: All boxes should contain a figure or preceding zeros. If test is not made, put "X's" in every box.
EXAMPLE: If C.O.D. is 29.3 mg/l(ppm) enter as follows [2|9|.|3] ;
If Turbidity is 50 units, enter as follows [0|0|0|5|0].

1. TEMPERATURE	[0|1.|0] (13 – 15)	Degrees C. to tenths
2. DISSOLVED OXYGEN	[1|3.|5] (16 – 18)	mg/l to tenths
3. pH	[0|8.|2] (19 – 21)	To tenths
4. BIOCHEMICAL OXYGEN DEMAND (B.O.D.)	[0|2.|0] (22 – 24)	mg/l to tenths
5. CHEMICAL OXYGEN DEMAND (C.O.D.)	[0|2.|9] (25 – 27)	mg/l to tenths
6. CHLORINE DEMAND - 1 HOUR	[0|1.|4] (28 – 30)	mg/l to tenths
7. CHLORINE DEMAND - 24 HOURS	[0|4.|4] (31 – 33)	mg/l to tenths
8. AMMONIA NITROGEN (NH_3-N)	[0.|0|2] (34 – 36)	mg/l to hundredths
9. CHLORIDES	[0|0|1|2] (37 – 40)	mg/l in units
10. ALKALINITY (as $Ca\ CO_3$)	[0|2|0|6] (41 – 44)	mg/l in units
11. TOTAL HARDNESS	[2|7|8] (45 – 47)	mg/l in units
12. COLOR	[0|0|8] (48 – 50)	In scale units
13. TURBIDITY	[0|0|8|0] (51 – 54)	In scale units
14. SULFATES	[2|1|5]	mg/l in units
15. TOTAL DISSOLVED SOLIDS	[5|9|3]	mg/l in units
16. _____	[ ]	

DISTRIBUTION: Original (White) to PHS-DSES Basic Data Unit, Washington, D. C.; Blue Copy to SEC, Cincinnati, Ohio; Salmon Copy to PHS Regional Office; Yellow Copy to State Agency; and Pink Copy for Retention by Laboratory.

PHS-2845-1 (10-57) WATER QUALITY BASIC DATA REPORT (FIELD)

FORM APPROVED: BUDGET BUREAU NO. 68-R6 34

Figure - 9

PRESENTATION OF RESULTS

The Water Supply and Water Pollution Control Program in Washington will process and print all data. This will be done by transferring data from the original sheets to machine-punched cards for listing in chronological order of testing, in such manner that the determinations performed by the cooperating laboratories and by the Sanitary Engineering Center will be coordinated. A national compilation is planned on an annual basis showing the chronological results by station. Since laboratory reports will be machine-punched on cards as received, the annual summary listing can be made available shortly after the results for the "data year" have been received.

Interim reports can be prepared with data listed by geographical area, such as by state or by major and/or minor river basins. The machine tabulation operation is also capable of carrying out statistical analyses of the data such as the development of means, medians, and frequency distributions. Requests for special analyses of the data, and for tabulations covering particular areas, should be made to the Public Health Service Regional Office concerned.